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(54) **A polishing and smoothing machine for slabs, tiles and the like.**

Polier- und Glättmaschine für Platten, Kacheln und dergleichen

Machine pour aplanir et polir des dalles, du carrelage ou similaire

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## Description

[0001] The invention relates to a polishing-smoothing machine for slabs, tiles and the like.

[0002] In particular, but not exclusively, the invention is applicable in the smoothing of marble slabs and ceramic tiles made of the material known as porcelain stoneware.

[0003] WO-A-95/30515 discloses the nearest prior art and particularly describes a polishing-smoothing machine for slabs, tiles and the like, comprising

a mobile rest plane for the slabs or tiles, whereon the slabs or tiles are conveyed in a predetermined direction;

a rotating platform, commanded to rotate about an incident axis on said mobile rest plane and provided with at least one frontal rotating grinding wheel which rotates about an axis not coinciding with the rotation axis of the platform and which is predisposed to operate in contact with at least one slab or tile situated on said plane;

said rotation axis of said at least one frontal rotating grinding wheel being inclined, having a inclination which is predetermined with respect to a perpendicular of said mobile rest plane.

[0004] The prior art teaches polishing marble slabs and porcelain stoneware tiles using sanding machines having a plurality of grinders arranged in line which operate on the slab or tile first by smoothing the work-surface and then, with a series of passages under progressively-finer grinders, by progressively polishing same. A characteristic of this working technique is the removal of a considerable breadth of material from the face of the slab or tile, i.e. a breadth which is sufficient to produce a perfectly flat surface which is necessary in order to obtain a fine shine.

[0005] For porcelain stoneware tiles, in particular, this type of sanding has the drawback of opening up micro-porosities (which are not present in the piece as it exits from the kiln) which causes the polished surface to stain when in contact with dirt particles small enough to lodge in these porosities. Consequently it is usually necessary to apply a further proofing process, whereby the tiles are treated with a substance able to impregnate the micro-porosities and render them safe from dirt infiltration.

[0006] A further serious limitation of the prior art relating to sanding is that it is not at all able to produce a smooth finish or polish on irregular, i.e. not perfectly flat surfaces. This in effect means that the kinds of tile known as structured, which are designed to have irregular rough surfaces (the prior art, indeed, presupposes that all surface irregularities have to be levelled before polishing can take place) cannot be polished.

[0007] The present invention, as it is characterised in the claims that follow, provides a polishing and smoothing machine able to carry out a surface treatment which

makes the tile or slab surface shinier and smoother without detracting from the original geometric conformation thereof.

[0008] A further aim of the present invention is to perform a smoothing operation which is characterised by the removal of a very small breadth of material.

[0009] A still further aim of the present invention is to realise various degrees of finish without leaving any sign of working whatsoever on the worked surface.

[0010] An advantage of the present invention consists in its constructional, functional and operative simplicity.

[0011] A further advantage of the present invention is its ability to work with consistent results on products having flat and regular surfaces but also on those having irregular surfaces and conformations.

[0012] A still further advantage of the present invention consists in the fact that it can be used for obtaining special products, such as antiquated marbles.

[0013] A yet further advantage is that the operation of the invention is very economical.

[0014] Further characteristics and advantages of the present invention will better emerge from the detailed description that follows of some preferred but non-exclusive embodiments of the invention, illustrated purely by way of nonlimiting examples in the accompanying figures of the drawings, in which:

figure 1 is a schematic vertical-elevation frontal view of a first embodiment of the invention;

figure 2 is a schematic lateral view from the left of figure 1;

figure 3 is a schematic view from above of figure 1 with some parts removed better to evidence others;

figure 4 is a schematic frontal view of a second embodiment of the invention. With reference to the figures, 1 denotes in its entirety a mobile rest plane for slabs or ceramic tiles 2 along which the tiles are translated in the direction indicated by the arrow 5. The plane 1 is constituted, for example, by the upper branches 10 of a normal pair of conveyor belts for ceramic tiles supported during motion by guides 11, horizontal guides in the present example. In the first embodiment shown, a rotating platform 3 is arranged above the plane 1. The platform 3 rotates about an axis x-x which is perpendicular to the plane 1 and arranged on the same longitudinal halfway-line. The platform 3 is mounted on a motor head 6 which in turn is vertically-slidably coupled on a vertical guide 7 fixed to a frame. A known-type device, not illustrated in the figures, presses the motor head 6 downwards against the tiles on the plane; the entity of the downwards pressure being adjustable and predetermined.

[0015] The rotating platform 3, in the embodiment shown in figures 1 and 2, inferiorly bears a plurality of rotating frontal brushes 4 which are arranged in such a way as to form a crown about axis x-x of the platform

itself.

**[0016]** With reference to the presence of a plurality of frontal rotating brushes supported on the rotating platform, it should be noted that the essential characteristics and specific functionality of the invention are all perfectly expressed in an embodiment having at least one frontal rotating brush, obviously having all of the attributes of each of the frontal rotating brushes of said plurality of brushes.

**[0017]** The frontal rotating brushes 4 are mounted idle on the platform 3, that is, with full rotating liberty about respective axes thereof, which axes are inclined at a predetermined angle with respect to a perpendicular of the plane 1. In particular, the rotation axis of each brush 4 is contained within a plane which also contains the rotation axis x-x' of the platform 3. The angle at which the rotation axis of each brush 4 is inclined with respect to the perpendicular of the plane 1 is small - preferably about 1 sexagesimal degree.

**[0018]** The rotation axes of the brushes 4 are arranged in such a way that the active frontal surfaces of the brushes are turned towards the rotation axis x-x' of the platform.

**[0019]** Each brush 4 is constituted by a disc 40. Bristles 41 are arranged in a circular crown on the downwards-turned face of the disc 40, which bristles can be made of any of various materials. In the present example, concerned with porcelain stoneware, they are made of a composite, the preference being for a plastic material functioning as a bond comprising abrasive particles of a predetermined granulometry.

**[0020]** During normal functioning the slabs or tiles 2 are translated on the plane 1 in the direction indicated by the arrow 5. Two lateral containment edges 9, situated in the operative zone of the brushes 4, prevent lateral displacements of the tiles 2 during the smoothing operation.

**[0021]** The brushes 4 contact the upper surface of the slab or tile 2 with a predetermined pressure obtained with said known device (not illustrated) having the task of keeping the whole motor head 6 pressed downwards (i.e. against the surface of the slab or tile 2) at a predetermined and adjustable pressure.

**[0022]** Each brush 4 comes into contact with the upper surface of the slab or tile 2 only at one zone of the brush 4 frontal surface, due to the fact that the brush 4 rotation axis is slightly inclined with respect to the perpendicular of the upper surface of the slab or tile 2. This geometric situation, combining with the rotation about its own axis x-x' of the platform 3, generates a tangential force on the brush, causing it to rotate. Thus, when the brushes 4 are in contact with the slab or tile 2 they are automatically drawn into rotation about their respective axes.

**[0023]** As a result of the combination of movements generated, the ends of the bristles 41 come into contact with the upper surface of the slab or tile 2, dragging thereupon over short tracts thereof, during which,

thanks to the abrasives contained in the bristles themselves, a mechanical smoothing action is produced, characterised by the removal of very small quantities of material.

**[0024]** Overall, when working on homogeneous materials, the original profile of the workpiece surface is not changed (in this case, the workpiece surface being the whole upper surface of the slab or tile 2); the operation is limited to smoothing the surface.

**[0025]** For the above reason, the device is particularly useful in smoothing-polishing operations on irregular and not perfectly flat surfaces, such as those of tiles made of porcelain stoneware, known as "structured".

**[0026]** A further fundamental characteristic of the invention is that it polishes and smooths without leaving any marks, such as scoring, on the workpiece surface, independently of the degree of finishing required. This degree of finishing essentially depends on the granulometry of the abrasive contained in the bristles forming the single brushes.

**[0027]** In order to obtain a predetermined degree of slab or tile surface finish, the work surfaces are passed through a series of machine operations, rather like the one described above. The machines are arranged in line, and each is equipped with brushes 4 having bristles 41 impregnated with abrasives of varying granulometry. The work order is organised so that a gradually decreasing abrasive granulometry (as well as different kinds of abrasives) comes into contact with the work surface.

**[0028]** A further embodiment of the invention uses a platform 3' arranged with its rotation axis x'-x' inclined with respect to the vertical of the plane 1'. In this case, too, the inclination is of small entity, preferably about 1 degree.

**[0029]** The platform 3' bears a plurality of brushes 4', structurally identical to the brushes 4 of the first embodiment, but having rotation axes parallel to the rotation axis x'-x' of the platform 3'. Thus the axes thereof are also inclined with respect to the perpendicular of the plane 1'. This geometrical situation is the cause of the rotation of the brushes 4', which are in contact with the underlying slab or tile 2, due to the effect of the rotation of the platform 3'. The overall result is similar to that obtained in the first embodiment.

## Claims

1. A polishing-smoothing machine for slabs, tiles and the like, comprising:

a mobile rest plane (1) for the slabs or tiles (2), whereon the slabs or tiles (2) are conveyed in a predetermined direction;  
a rotating platform (3, 3'), commanded to rotate about an incident axis on said mobile rest plane (1) and provided with at least one frontal rotating brush (4, 4') which rotates about an axis not

coinciding with the rotation axis of the platform (3, 3') and which is predisposed to operate in contact with at least one slab or tile (2) situated on said plane (1);

said rotation axis of said at least one frontal rotating brush (4, 4') being inclined, having a inclination which is predetermined with respect to a perpendicular of said mobile rest plane (1).

2. The machine of claim 1, characterised in that the rotation axis of said platform (3, 3') is contained in a plane which is parallel to an advancement direction of the slabs or tiles (2) on said mobile plane (1) and which is perpendicular to said mobile plane (1).
3. The machine of claim 2, characterised in that the at least one frontal rotating brush (4, 4') is mounted idle on said platform (3, 3'), having full freedom rotation about an axis thereof.
4. The machine of claim 3, characterised in that the rotation axis of the platform (3, 3') and the rotation axis of the at least one frontal rotating brush (4, 4') are coplanar.
5. The machine of claim 4, characterised in that the rotation axis of the platform (3) is perpendicular to the mobile rest plane (1).
6. The machine of claim 5, characterised in that the rotation axis of the at least one frontal rotating brush (4) is inclined with respect to the perpendicular of the mobile rest plane (1), said perpendicular axis being parallel to the rotation axis of said platform (3), with a small-entropy inclination angle.
7. The machine of claim 1, characterised in that the at least one frontal rotating brush (4, 4') is constituted by a disc (40) on a face of which bristles (41) are fixed and arranged in a circular crown pattern; said bristles (41) exhibiting a composite structure constituted by a plastic material functioning as a bond and containing particles of abrasive material.
8. The machine of any one of the preceding claims, characterised in that said rotating platform (3) is provided with a plurality of said frontal rotating brushes (4) which are arranged in such a way as to form a crown configuration about the rotation axis of the platform (3).
9. The machine of claim 8, characterised in that the frontal rotating brushes (4) of said plurality of brushes exhibit rotation axes which are equally inclined with respect to the rotation axis of the platform (3).
10. The machine of any one of the preceding claims from 1 to 4 and claim 7,

characterised in that the rotation axis of said rotating platform (3') is inclined, with a small entropy of inclination, with respect to the perpendicular of said mobile rest plane (1); the rotation axis of said at least one frontal rotating brush (4') being parallel to the rotation axis of the platform (3').

11. The machine of claim 10, characterised in that said rotating platform (3') is provided with a plurality of said frontal rotating brushes (4'), which are arranged in such a way as to form a crown about the rotation axis of the platform.

## 15 Patentansprüche

1. Polier- und Glättmaschine für Platten, Kacheln und dergleichen, enthaltend:

eine bewegliche Auflagefläche (1) für die Platten oder Kacheln (2), auf welcher die Platten oder Kacheln (2) in einer bestimmten Richtung weitergeleitet werden;

eine drehbare Plattform (3, 3'), die angetrieben wird, sich um eine auf die bewegliche Auflagefläche (1) auftreffende Achse zu drehen und mit wenigstens einer frontalen, drehbaren Bürste (4, 4') versehen ist, welche sich um eine nicht mit der Drehachse der Plattform (3, 3') übereinstimmende Achse dreht und dazu vorgesehen ist, im Kontakt mit wenigstens einer der auf der genannten Fläche (1) liegenden Platten oder Kacheln (2) zu arbeiten;

wobei die genannte Drehachse der genannten wenigstens einen frontalen, drehbaren Bürste (4, 4') geneigt ist, wobei sie eine Neigung hat, die im Verhältnis zu der Lotrechten der genannten beweglichen Auflagefläche (1) festgelegt ist.

2. Maschine nach Patentanspruch 1, **dadurch gekennzeichnet**, dass die Drehachse der genannten Plattform (3, 3') in einer Ebene enthalten ist, die parallel zu einer Vorschubrichtung der Platten oder Kacheln (2) verläuft, und welche lotrecht zu der genannten beweglichen Auflagefläche (1) ist.

3. Maschine nach Patentanspruch 2, **dadurch gekennzeichnet**, dass wenigstens eine frontale, drehbare Bürste (4, 4') leerlaufend an der genannten Plattform (3, 3') montiert ist, wobei sie volle Drehfreiheit um ihre Achse hat.

4. Maschine nach Patentanspruch 3, **dadurch gekennzeichnet**, dass die Drehachse der Plattform (3, 3') und die Drehachse von der wenigstens einen frontalen, drehbaren Bürste (4, 4') koplanar sind.

5. Maschine nach Patentanspruch 4, **dadurch gekennzeichnet**, dass die Drehachse der Plattform (3, 3') lotrecht zu der beweglichen Auflagefläche (1) verläuft.
6. Maschine nach Patentanspruch 5, **dadurch gekennzeichnet**, dass die Drehachse von der wenigstens einen frontalen, drehbaren Bürste (4) im Verhältnis zu der Lotrechten der beweglichen Auflagefläche (1) geneigt ist, wobei die genannte lotrechte Achse parallel zu der Drehachse der genannten Plattform (3) verläuft, und zwar mit einem kleinen Neigungswinkel.
7. Maschine nach Patentanspruch 1, **dadurch gekennzeichnet**, dass die wenigstens eine frontale, drehbare Bürste (4, 4') aus einer Scheibe (40) besteht, auf deren einer Seite Borsten (41) befestigt und kreisförmig angeordnet sind; wobei die genannten Borsten (41) eine zusammengesetzte Struktur aufweisen, bestehend aus einem Kunststoffmaterial, welches als Bindemittel wirkt und Partikel von Schleifmaterial enthält.
8. Maschine nach einem beliebigen der vorstehenden Patentansprüche, **dadurch gekennzeichnet**, dass die genannte drehbare Plattform (3) mit einer Anzahl der genannten frontalen, drehbaren Bürsten (4) versehen ist, welche auf solche Weise angeordnet sind, dass sie eine kronenförmige Darstellung rund um die drehbare Achse der Plattform (3) bilden.
9. Maschine nach Patentanspruch 8, **dadurch gekennzeichnet**, dass die frontalen, drehbaren Bürsten (4) der genannten Anzahl von Bürsten Drehachsen aufweisen, die im Verhältnis zu der Drehachse der Plattform (3) in gleicher Weise geneigt sind.
10. Maschine nach einem beliebigen der vorstehenden Patentansprüche von 1 bis 4 und nach Patentanspruch 7, **dadurch gekennzeichnet**, dass die Drehachse der genannten Plattform (3') mit einem kleinen Neigungswinkel im Verhältnis zu der Lotrechten der genannten beweglichen Auflagefläche (1) geneigt ist; wobei die Drehachse der genannten wenigstens einen frontalen, drehbaren Bürste (4') parallel zu der Drehachse der Plattform (3') verläuft.
11. Maschine nach Patentanspruch 10, **dadurch gekennzeichnet**, dass die genannte drehbare Plattform (3') mit einer Anzahl von genannten frontalen, drehbaren Bürsten (4') versehen ist, welche auf solche Weise angeordnet sind, dass sie einen kronenförmigen Darstellung rund um die Drehachse der Plattform bilden.

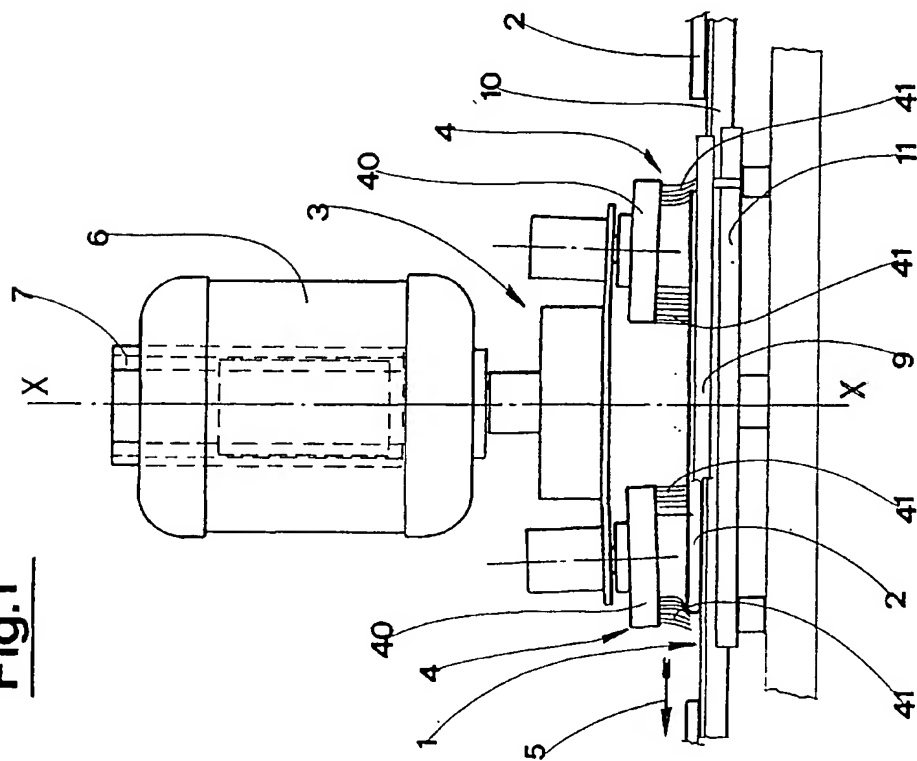
## Revendications

1. Une machine pour aplanir et polir des dalles, du carrelage ou similaire, comprenant:
  - un plan d'appui mobile (1) pour les dalles ou carrelage (2), sur lequel les dalles ou carrelage (2) sont convoyés dans une direction prédéterminée;
  - une plateforme rotative (3, 3'), commandée pour pivoter autour d'un axe incident audit plan d'appui mobile (1) et pourvue d'au moins une brosse frontale rotative (4, 4') qui pivote autour d'un axe ne coïncidant pas avec l'axe de rotation de la plateforme (3, 3') et qui est prédisposée pour opérer en contact avec au moins une dalle ou carrelage (2) situé sur ledit plan (1); ledit axe de rotation de ladite brosse frontale rotative (4, 4') étant incliné, ayant une inclinaison prédéterminée par rapport à une perpendiculaire audit plan d'appui mobile (1).
2. La machine selon la revendication 1, caractérisée en ce que l'axe de rotation de ladite plateforme (3, 3') est contenu dans un plan parallèle à une direction d'avancée des dalles ou carrelage (2) sur ledit plan mobile (1) et perpendiculaire audit plan mobile (1).
3. La machine selon la revendication 2, caractérisée en ce qu'au moins une brosse frontale rotative (4, 4') est montée folle sur ladite plateforme (3, 3'), ayant une totale liberté de rotation autour de son propre axe.
4. La machine selon la revendication 3, caractérisée en ce que l'axe de rotation de la plateforme (3, 3') et l'axe de rotation de la brosse frontale rotative (4, 4') sont coplanaires.
5. La machine selon la revendication 4, caractérisée en ce que l'axe de rotation de la plateforme (3) est perpendiculaire au plan d'appui mobile (1).
6. La machine selon la revendication 5, caractérisée en ce que l'axe de rotation de la brosse frontale rotative (4) est incliné par rapport à la perpendiculaire au plan d'appui mobile (1), ledit axe perpendiculaire étant parallèle à l'axe de rotation de ladite plateforme (3), avec un léger angle d'inclinaison.
7. La machine selon la revendication 1, caractérisée en ce que la brosse frontale rotative (4, 4') est constituée d'un disque (40) sur une surface duquel des poils (41) sont fixés et disposés dans une forme de couronne circulaire; lesdits poils (41) présentant une structure composite constituée d'une matière plastique ayant la fonction d'un liant et contenant

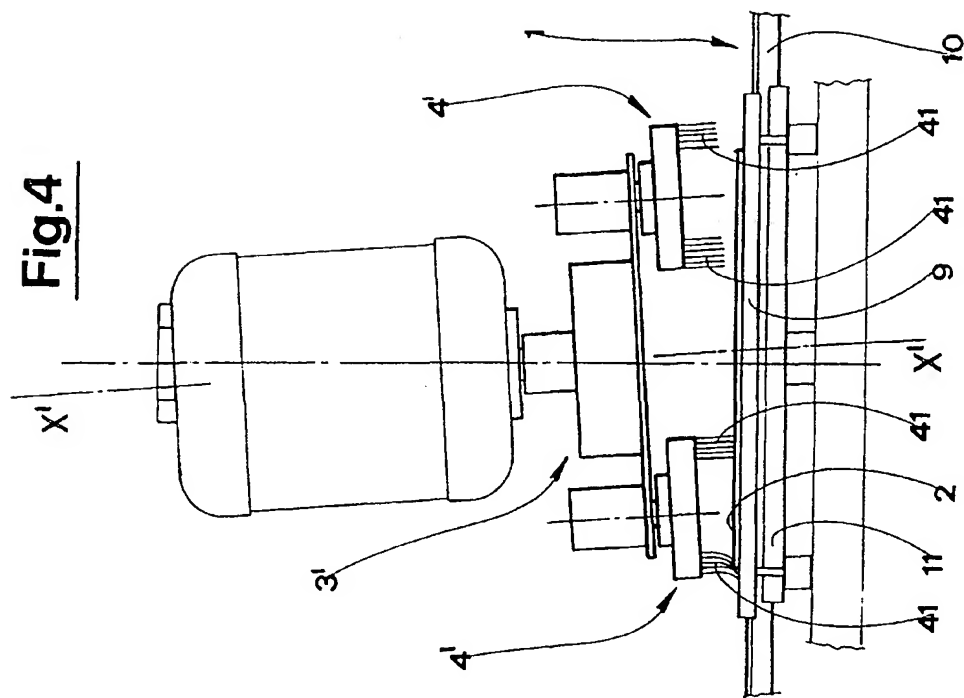
des particules de matériau abrasif.

8. La machine selon n'importe laquelle des revendications précédentes, caractérisée en ce que ladite plateforme rotative (3) est pourvue d'une pluralité de brosses rotatives (4) disposées de manière à former une couronne autour de l'axe de rotation de la plateforme (3). 5
9. La machine selon la revendication 8, caractérisée en ce que les brosses frontales rotatives (4) constituant ladite pluralité de brosses présentent des axes de rotation inclinés selon le même angle par rapport à l'axe de rotation de la plateforme (3). 10 15
10. La machine selon n'importe laquelle des précédentes revendications 1 à 4 et 7, caractérisée en ce que l'axe de rotation de ladite plateforme rotative (3') est incliné, selon un léger angle d'inclinaison, par rapport à la perpendiculaire audit plan d'appui mobile (1); l'axe de rotation de ladite brosse frontale rotative (4') étant parallèle à l'axe de rotation de la plateforme (3'). 20 25
11. La machine selon la revendication 10, caractérisée en ce que ladite plateforme rotative (3') est pourvue d'une pluralité de brosses frontales rotatives (4'), disposées de manière à former une couronne autour de l'axe de rotation de la plateforme. 30 35 40 45 50 55

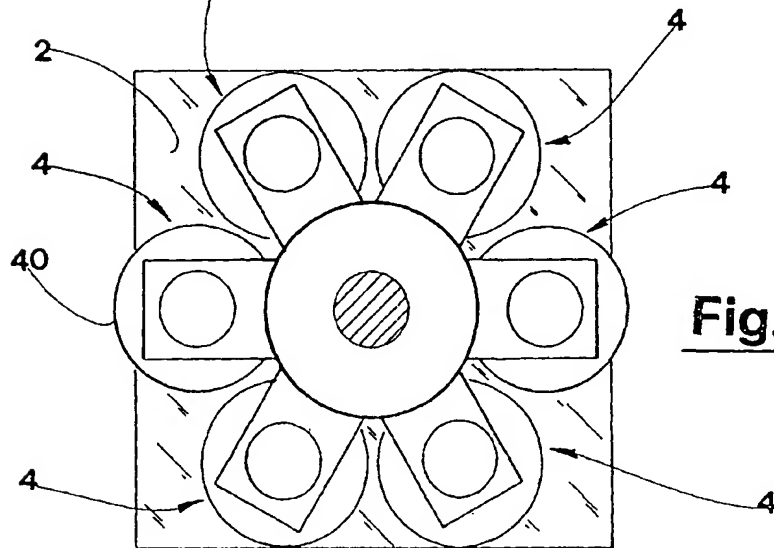
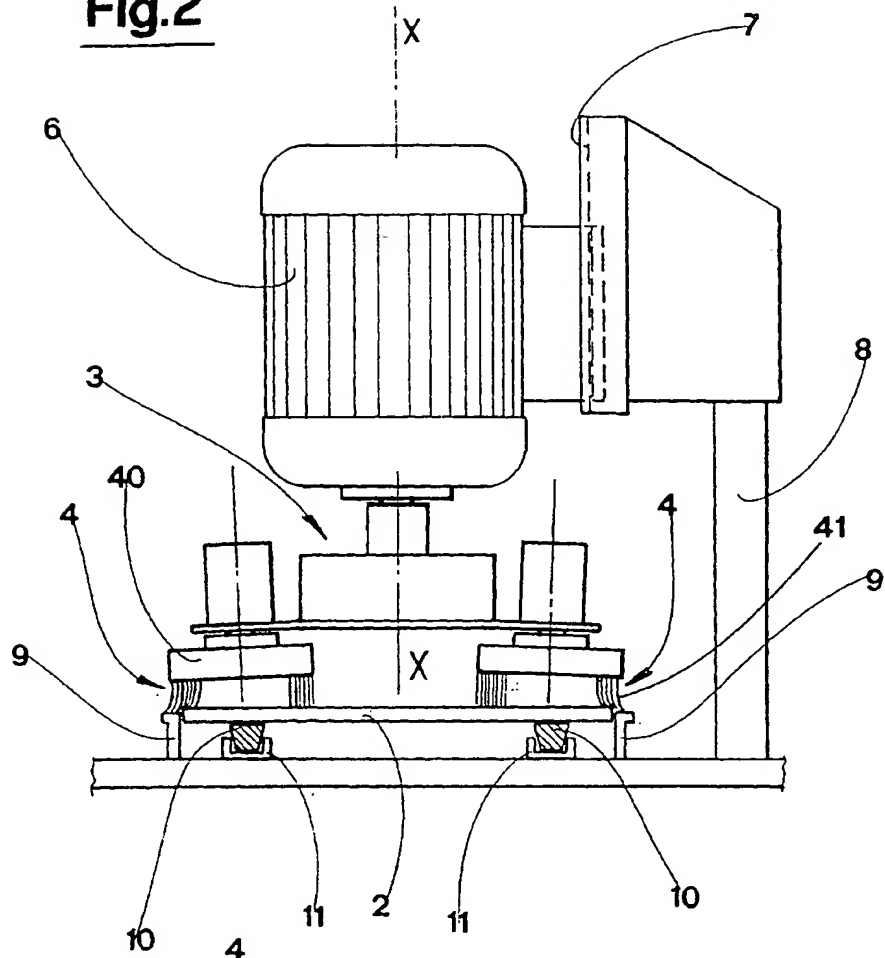
**Fig.1**



**Fig.4**



**Fig.2**



**Fig.3**